Subject (System dynamics) Date : lec1

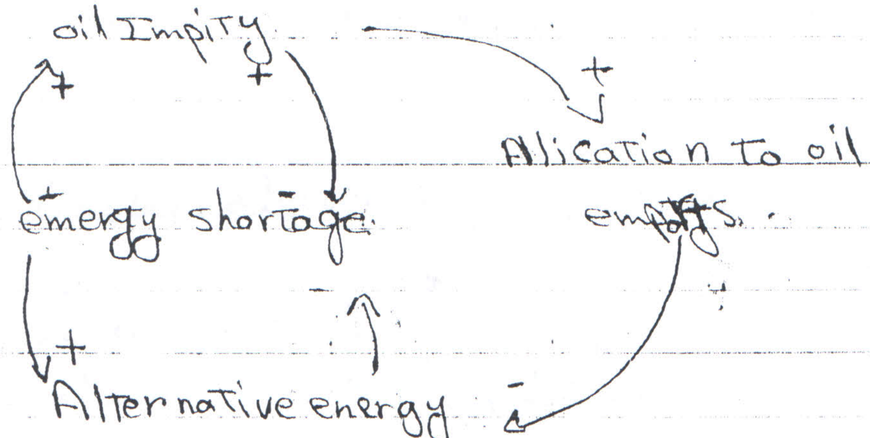
Report: Modes of thinking, UML, MIT

UML → unified modeling language diagrams.
عبارة عن modeling طريقة التفكير عندنا ل SW

modeling → is abstruction of reality. حاجة شبه الحقيقة.

- discrete model — model مثل توافد العملاء في بنك مثلا
- physical model — model مشابه من حيث الشكل
- continous model
- mathematical modeling — model موتور
- stochastic model

أي مشكلة ليها حليه
→ حل ظاهري : Quick solution
→ حل حقيقي Foundmental solution



(ضعيف) تغيير غير مؤثر اوي

التغير الحقيقي يكون على بنيه

(System) events → behaviour → structure of system

clear — headen — relation with

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using modeling for.

1- solve problem.

2- senistivity analysis

Current state - initial, final states. أي model

difference between initial, final states. ← problem

foundumental solution ← time delay solution.

* Same times the queue (الطابور) with delay is more worst than the effect of the decise. (القرار)

* أي مشكلة لها quick solution ←

(take Long time) Foundamental solution ←

* problem = destined - wanted. (المعايير لتوصيله)

Problem charachtristic

① problem can be or not (أي تقدر تخليها أو لا)

composed.

أي بيقبل تتجزء الأجزاء كل منفردة أم لا.

ex: mathematical problems, medical problem.

② The solution steps accept undo or not.

المشكلة التي تقبل التراجع تصبح أسهل في الحل

③ The solution is relative or absolute.

human 99% of ther decision is relative decision.

absolut solution.
solution the we wish to achive without comparison with any other things.
relative solution of problem is more difficult.

(4) The solution steps is parthor State.
هل الحل عبارة عن حالة مركوز بالوصول إليها أم مسار مركوز فيه.
ex:: State puzzel
path work (is more difficult)

(5) the environment of solution or problem is predictable or not.
environment is effects on any system.
ex:: Cheaset (الشطرنج), taks driver.

(6) The role of Knowlage. (related to the problem)
المعرفة دورها في الشطرنج أو puzzle.

(7) role of human in problem.
حل المشكلة بدون بشر أسهل من استخدام الروبوت وهي أيضا دي إذا اختلاف model
model without human. is more easy than with human.

* * *

lect
* Two Loops → Balanced loop.
→ en forced loop. متعمدة

* limit of growth.

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* Causal loop diagram

* أكتب شوف تأثير الأسباب على المشكلة .

* بنشوف عدد + , -

no.of + odd → Balanced.
no.of - even → unBalanced.

* Stability. Balanced ≅ enforce.

* System behaviour
is dependent on no. of loops.

← eighty twenty (80 , 20)
أي 80% من المشكلة بتحله بـ 20% من الأسباب .
ملحوظة
* س ـ و Quick solution قد تؤدي إلى تراجع التقدم في Fundamental solutions

Subject : _____ Date : lec 3.

I think. depend on.

* Causal loop diagram.
* Stock Flow.

Stock

عند توقف الوقت يستمر Stock

(مخازن فلوس)

حاجه موجوده قابل للزياده والنقصان

Flow

مرتبط بالوقت

(يصرف الفلوس)

أي System

موجوده من stocks ويستقبل من stock لـ stock عن طريق Flow

* الأقل بـ physical meaning is integeration.

Types of Stock

① material
② personal
③ Capital equipment (أي مفيش مواد ولكن يوجد معدات أدوات رأسمالي) يعني أدوات الإنتاج
④ orders "أي شخص يأخذ أوامر وبعض الأشخاص أوامر أيضًا"
⑤ money
⑥ information.

Auxillary variable. هو عبارة عن متغير خارجي يقع في النظام.
ولكن يؤثر على ديناميكية النظام. مثل (المنافسين لأي sales)

Stock Flow model

① Stock
② Flow
③ auxillary variable.

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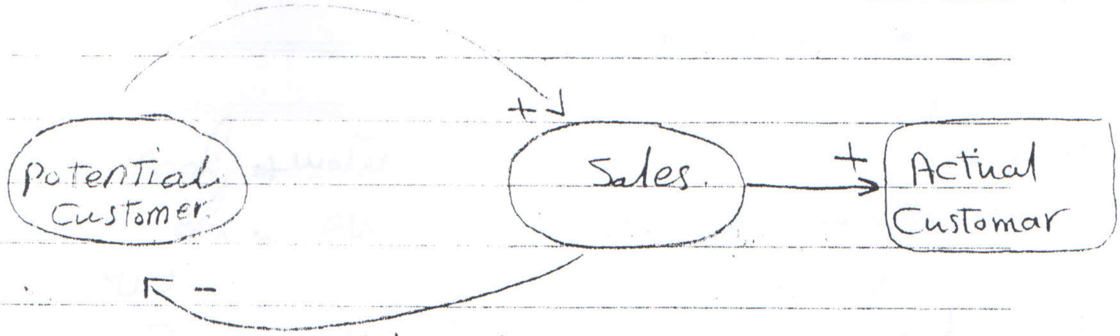
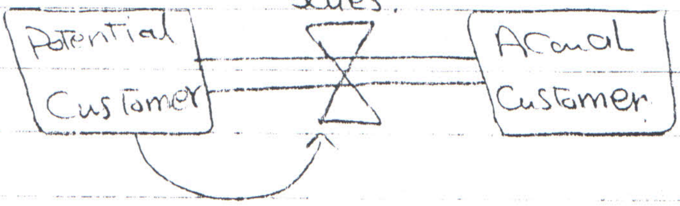
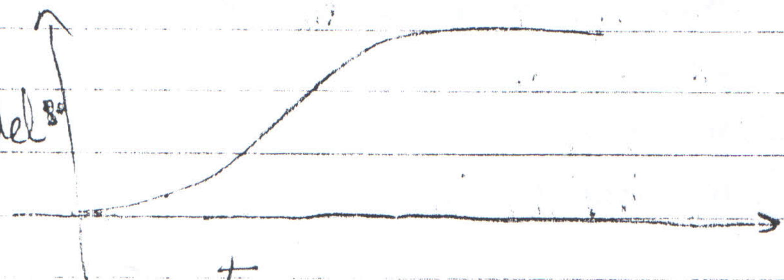
* عند دراسة أي model يجب اعتبار المتغيرات الداخلية والخارجية



Causal loop diagram



s_shaped model



Actual Customer $= \int_0^t$ Sales . dt

Potintial = I - Acual model

(= P   العدد الكلي (مثل خزان ممتلئ) والمقصود هو

omulation, modeling, simulation.   ما الفرق بين

Subject : ______________ Date : ______________

* potential Customer
مثلاً دورات cisco عدد الطلبه الي هيدخلو اربع فرقه حاسبات

* actual Customer
هما الطلبه الي سجلو بالفعل .

* Stack. لا يقبل الـ negative.

* Flow " " " " " " أيضاً

performance يتنج من simulation.

State vailable ((Flow)).

متغيرات الحالة ($\dddot{x}$, $\ddot{x}$, $\dot{x}$, x)

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System

(من داخل النظام) internal Flow
، external Flow
عبارة عن Flow of data.

* stock order (مستفيد من النظام (مثل الطالب (متلقى خدمه من النظام) والكليه)

extengle entity ← اما بيأخذ Data من النظام أو بيمد النظام بال data.

* DFD → (UML) unified modeling language.
→ Data Flow diagram.
أى اتجاه تدفق الـ data من مكان لمكان فى النظام

System → group of entities cooperated to do some taskes
→ group of interconnected subsystem.

goals → عند تصليح عيوب system يجب البدء فى التصليح إداريًا أولاً ثم فنيًا
لا يجب للشخص أن يكون Descion maker, taker فى نفس الوقت

manager → decision maker.

decision maker (* يقوم بدراسه المشكله من كل الجوانب وعمل modeling (ليفكر فى الحلول) الممكنه ،
decision taker. * يختار القرار النهائى للمشكله.

* = → causal loop diagram mean : there are a delay time.
أى تأثير الـ loop هيظهر تأثيره وذلك بعد فترة مرحليه.

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إزاحة المشكلة
Shifting the berding.

أي عمل تأجيل لها. أو عدم توزيعها وتقسيمها محاخفف من تأثيرها ولكنه ليس حلاً أبداً لها (Quick solution.)

ex DFD ┌ oop
└ structure. المكتبة

* عبارة عن مجموعة من objects التي تتفاعل مع بعضها
message.
* طريقة التواصل بين objects ويتم تحديد داخلها method.
* class تحديد الـ methode (without specific attrebuites)
* objects ذات methods المتساوية يتم تجميعهم داخل class واحد.
* لكن الموجود في الحقيقة objects (specialization.)
* الزواحف (generalization) والسحالي specialization
* عبارة عن diagram. (analysis , design, programming) يشرح UML

*message. ((نوع العملية السيارة), (اسم الاتجاه) (اسم الشخص والغرفة))
أي تحتوي على methodes التي تحتاج إليها الـ data الخاصة بها.

Function decomposion. ⟵ الفك الوظيفي للنظام

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DFD
- → External entity (التعريف) مثل الطالب بالنسبة للكلية)
- → process (is an action in the system).
- → Data Stor (مثل السجل كذا)
- → Data Flow "هو انتقال البيانات من مكون في DFD إلى مكون آخر"

external entity ← يمكن أن يتمكن من التغيير في external entity لا

systems
- → interactive systems.
- → Isolated systems. لا يوجد هذا النوع في الواقع

Data Store: أي يتم تخزين data واخراجها مرة أخرى.

Business developer (modeler).

الكون

system ← بيئة universe.

لا يوجد system بدون
- → datastore (ممكن أن يكون لديه I/OP أو I/P فقط)
- → external entities
- → process (الامتحان ـ النتيجه)
- → data flow

لا يوجد تواصل بين datastore ـ data store

external entities ـ external entities

external entity ـ data store. لازم يكون بينهم process.

external entity يظهر داخل النظام عن طريق actions إلى (send data or recieve data.) يقوم بربط

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* النتيجة عبارة عن Data Flow .

* entity عبارة عن حاجة متضمنة مجموعة attributes .

* الزمن هو المتغير الوحيد الغير معتمد في تغيره على أي متغير آخر.

Dynamic process تعتمد على التغير الوقت (T is independent) .

static (DFD أي مجموعة خطوات ثابتة عند تكرار نفس action

DFD
- Function decomposion
- Static modeling

process يجب تسميتها بـ (verb) ولديها أرقام ويتم رسمها على شكل

(4) المريض بالنسبة للمستشفى external entity .

DFD ← يتم رسمه على هيئة leveling .

process ← الوحيدة التي تحتوي على parente و childe
أي يتم تقسيمها إلى مجموعة من subprocess

ويتم التقسيم يبدأ من أعلى إلى أسفل .

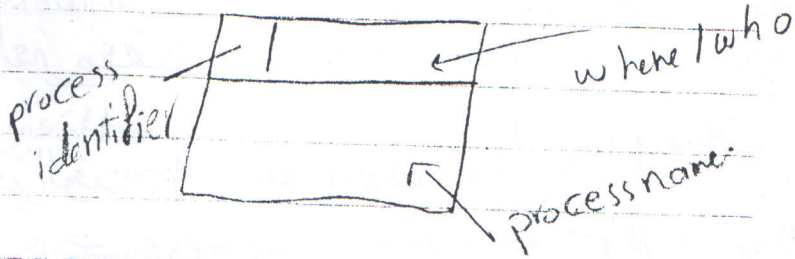
DFD يحدد process ولكنه لا يمكنه تحديد levels إلا في شكل واحد.

OOP ← تستخدم في Busines الكبير

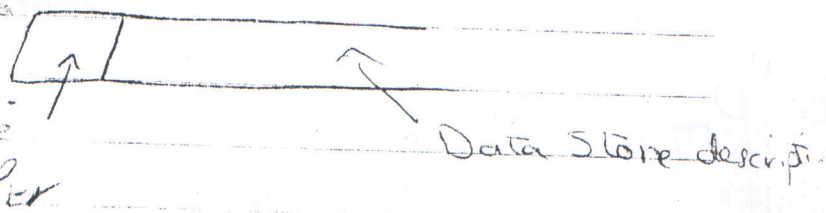
Subject : _____ Date : _____

① external entity

② process



Data Store.



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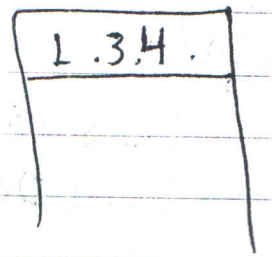
السياق
ConteXT Diagram

Data oriented modeling.

0, 1, 2 Diagram ترقيم

process 4 in D2 → parent P3 in D1 → parent P1 in D0



leveling يتبع DFD

* عالي leveling ينتهي باتساع مستوى التفاصيل.

verb (action) → process.
sheet, Fille, access, DB, وفتر - excelsheet → Datastone

أي نظام توضيح للعلاقة بين النظام والأنظمة الأخرى.

(process)action نظام ← external enti

* يتكون من single process. يحتوي على النظام + external entity
(إلى يتأثر من النظام أو تعطيه)

* لا يحتوي على تفاصيل داخلية للنظام لذلك تظهر فقط. datastore
في DFD.

* Data Flow diagram.

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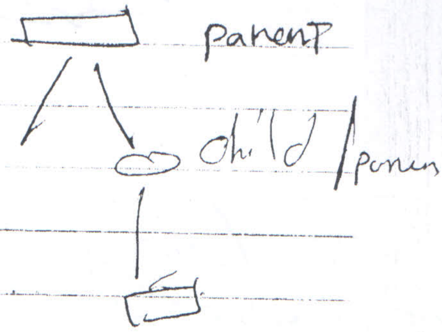
OOA object oriented Analysis.
OOD " " Data modeling.
OOP " " programming.

DFD
↳ systematic thinking
↳ Data store.

DFD →
[Dat dictionary — D.
[process discreption

Bussens Rules.

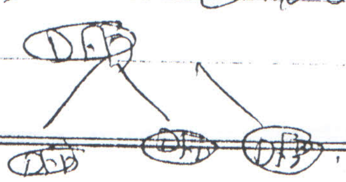
leveling
Level upestricion.



Balancing

اي لو في case ليها i/p , outp لو عملنا analysis عليها مرة أخرى بعيد نشتغل i/p o/p

parent → child ما بيكون من أكثر من



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Data item

Data dictionary يظهر في

أصل Data unit
حيا رقم أخر مكونها الرياضيات الفلك

Data Flow.

تتكون من مجموعة من
Data items.

يظهر في ال Diagram

عند الشرح في levels يحصل
agreegation of Data flow
decomposition.

لا يصح استخدام DFD إذا البـ.

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Introduction to Simulation.

Simulation. تمثيل

is imitation of the operation of a real-world process or system over time.

Brief explanations -

the behavior of a system as it evolves over time is studied by developing a simulation model.

model is Form of a set of assumptions Concerning the operations of the system. افتراضات

The assumptions are expressed in.

- Mathematical relationships
- Logical relation ship
- Symbolic relation ship.

When simulation is the Appropriate Tool? مناسبة

1. Simulation enables study and experimentation with the internal interactions of a complex system.

2. information, organizational and environmental changes can be simulated

- the Knowledge gained in designing a simulation.

model can be great value suggesting improvement in the system under investigation.

4- Simulation can be used to experiment with new designs or policies prior to implementation.

5- Simulation can be used to verify analytic solutions.

6- by simulating different capabilities for a machine, requirments can be determined

7- Animation shows a system in simulated operation so that the plan can be visualized.

When Simulation is Not Appropriate?

1- Simulation should be used when the problem cannot be solved using common sense.

2- Simulation should not be used if the problem can be solved analytically.

3- Simulation should not be used, if it is easier to perform direct experiments.

4- Simulation should not be used, if the costs exceeds savings.

5- simulation should not be used if the resources or time are not available.

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Advantages of simulation.

1- Simulation can also be used to study systems in the design stage

2- Simulation models are run rather than solver

3- "what if" questions can be answered, useful in the design of new systems

4- Time can be compressed or expanded allowing for a speedup or slowdown of the phenomena under investigation

5- new Hw designs, physical Layouts, transportation systems can be tested without committing resources for their acquistion

6- A simulation study can help in understanding how the system operates rather than how individuals think the system operates.

Disadvantages of simulation.

1- Model building requires special training.
2- Simulation results may be difficult to interpret.
3- Simulation modeling and analysis can be time consuming and expensive

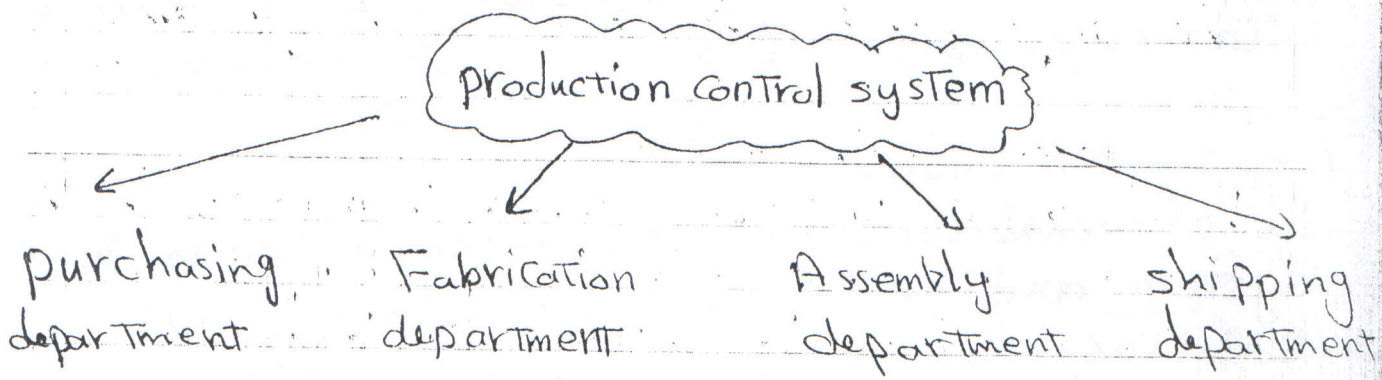
4- Simulation is used in some cases when an analytical solution possible or even preferable.

Applications of simulation.

1- manufactoring Applications
2- semi conductor manufacturing
3- Construction engineering
4- military Applications
5- Logistics, Transportation and Distribution Applications
6- Business process simulation
7- Human systems

Systems

A system is defined as an aggregation or assemblage of objects joined in some regular interaction or inter dependence toward the accomplishment of some purpose.



Components of a system:

1- Entity (is an object of interest in a system)

2- Attribute. (denotes the property of an entity)

3- Activity Any process causing changes in a system is called as an activity.

4- State of the system.
is defined as the collection of variable necessary to describe a system at any time, relative to the objective of study.
or
a description of all the entities, attributes and activities as they exist one point in time.

5- event
An event is defined as an instaneous occurrence that may change the state of the system.

6- System Environment.
the external components which interact with the system and produce necessary changes are said to continue the system environment.

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Compaine.

* Endogenous system
The term endogenous system is used to describe activities and events occurring within a system
EX Drawing cash in bank

* Exogenous system
the term exogenous is used to describe activities an events in the environment that affect the system
EX Arrival of customers

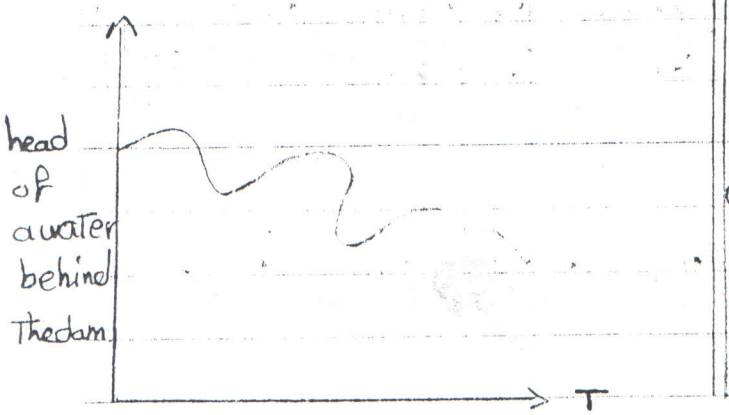
---

* Closed system
A system for which there is no exogenous activities and event is said to be a closed
EX water in an insulated flask

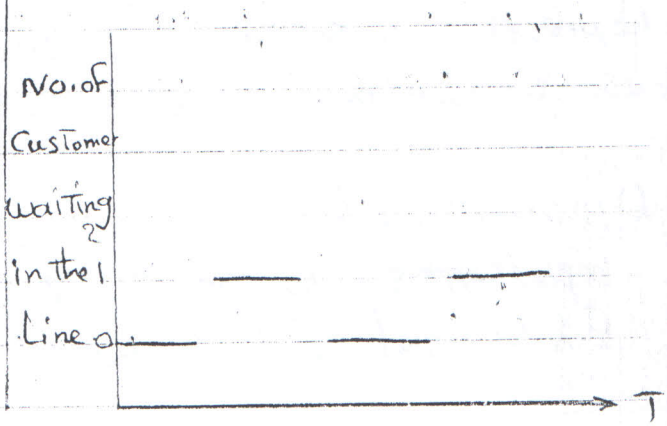
* open system
A system for which there is exogenous activities an event is said to be an open
EX Bank system

---

* Continous system
system in which the changes are predominantly smooth are called Continous system
EX: Head of a water behind a dam



* discrete system
system in which the changes are predominantly discontinous are called discrete system.
EX bank (no of customers)



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mode of a system.

A model is defined as a representation of a system for purpose of studing the system.

Types of models.

- mathematical or physical model
- Static model
- Deterministic model
- stochastic model.
- Dischete model
- Dynamic model
- Continous model.

* mathematical model.

Uses symbolic notation and mathematical equations To represent a system.

* Static model.

Represent a system at a particular point of time and also known as monte-carlo simulation.

* Dynamic model.

represents system as they change over time.
EX:- Simulation of a bank.

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* Deterministic model
Contains no random variables. they have a known set of inputs which will result in a unique set of outputs.
Ex: Arrival of patients to the Dentist at the scheduled appointment Time

* Stochastic model.
has one or more random variable as inputs. Random inputs Leads to random output.
Ex: Simulation of a bank involves random interarrival and service times.

* discrete and Continous model.
used in an analogous manner. Simulation models may be mixed both with discrete and Continous. The choise is based on the characteristics of the system.

* discrete-event system simulation
Modeling of system in which the state variable changes only at a discrete set of points in time.

Steps in a simulation study

① problem Formulation
every study begins with a statement of problem, provided by policy markers.

2- setting of objectives and overall project plan
the objectivies indicate the questions to be answered by simulation. the overall projectplan should include.

3- model conceptualization.
the construction of amodel is probably as much art as science.

4- Data collection
there is a constant interplay between the construction of model and the collection of needed input data.

5- model translation
real-world system result in models that require a great deal of information storage and computation.

6- verified
it pertains to hiscomputer program and checking theperformance if the input parameters and Logical structure and correctly represented. verification is completed.

7. validated.
itis the determination that a model is an accurate. representation of the real system.

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8. Experimental Design.
The alternatives that are to be simulated must be determined.
For each system design, decisions need to be made concerning
- Length of the initialization period.
- length of simulation runs.
- Number of replications to be made of each run.

9- production runs and analysis.
They are used to estimate measures of performance of the system designs that are being simulated.

10- More runs
Based on the analysis of runs that have been completed.

11. Documentation and reporting
Two Type of documentation 1- program documentation.
2- process documentation.

12- immplementation.
Success depends on the previous steps.

---

* the simulation model building can be broken into 4 phases

phase I
- Consist of steps 1 and 2
- it is period of discovery / orientation.

- the analyst may have to restart the process if it is not Fine tuned.
- Re calibrations an clarifications may occur in this phase or another phase.

phase II

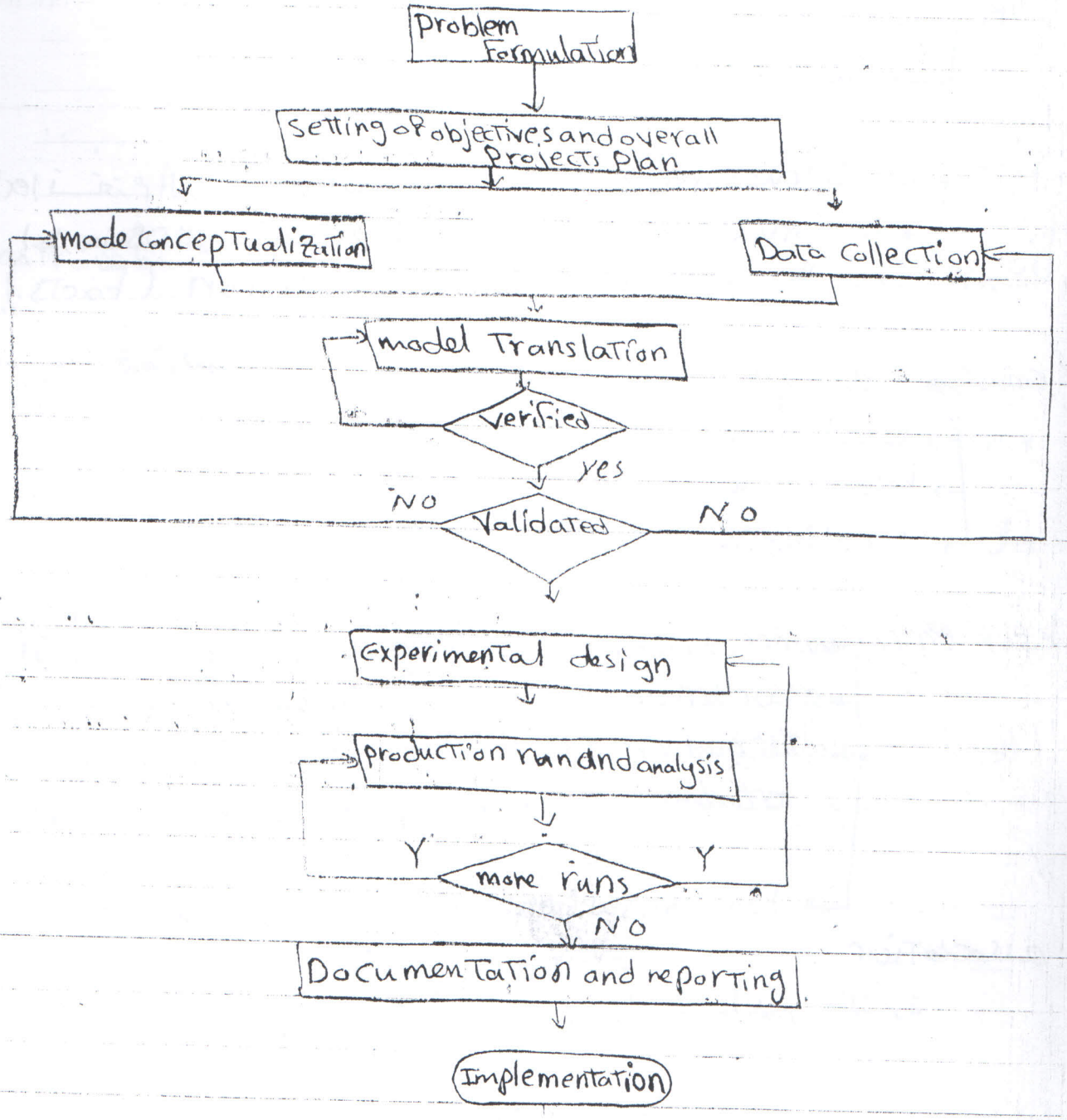
- Consists of steps 3, 4, 5, 6, 7
- A continuing interplay is required among the steps
- Exclusion of model user results in implications during implementation.

phase III

- Consists of steps 8, 9, 10
- Concerns a through plan for experimenting.
- Dischete-event stochastic is statical experiment.
- the o/p variables are estimates that contain random error

phase IV

- Consist of steps 11, 12
- Successful implementation depends on the involvement of user and every steps successful completion.


Problem Formulation
Setting of objectives and overall Projects Plan
mode conceptualization
Data Collection
model Translation
Verified
yes
NO
Validated
NO
Experimental design
production run and analysis
Y
more runs
Y
NO
Documentation and reporting
Implementation

Subject : E.R.D. Date : lec

DB → SQL
→ NO SQL

Data → STructured data . (relational algebra. ex ERD إستخدم الـ
→ unstructured data (relational algebra اي داتا التي لا تستخدم DB
is → * any thing can be measured or vision (Facts.)

DB consist → Entity ( )
→ Atributes
→ relation ships
→ constraints.

Types of entity → week entity (الواحدة بيعتمد على واحدة entity أخرى
→ associative entity (الواحدة يعتمد على أكثر من entity آخرين)
→ attributive entity (entity is take from parent.
Student → الشاب
→ الشهام
parent. لو احدهما خاص من
→ Fundumental entity. لا ينتمي للأنواع السابقة

associative. | week.
زي المسافر والطيارة والتذكرة.

attributes simpattribuite.
Composed
اسم العميد يري العضو.
Multivarasch atribut (الاسم - العائلة - العمر)
&
Multi variable + composed عكس انه يمز الجمع بين

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relation types. one To one
. many To one
. one To many
. many To maing

*Constraints. *cordanility.

* Domain Constraints. . (option).
: domain ال max و min *أي بيحفظ

*لا يوجد DB من دون Constraints.

Cardnality

الحد الأدنى أو الأقصى للحفاظ على العلاقة
(تعريف العلاقة ط relation (ولبس entity

DB. Conceptual modeling.
Logical modeling.
physical modeling.

refrentialintegrety. التكامل المرجعي
أحد أنواع Constraints

Subject : Date :

EED

Enhanced entity ~~Data~~ relationship diagram.

1) ERD لا يحتوي على overlapping ولكن EED تحتوي عليه.

أي object موجود في 2 entity

2) لا يسمح inheretances

3) لا تحتمل attributive entity في ERD ولكن EED محكم

generalization حاجة مش موجودة أصلاً / special case موجودة

Subject : introduction. Date : sec 1

Simulation.

is the imitation (تقليد) of the operation of a real-world process or system over time.

Brief explanation:

- The behavior of a system as it evolves overtime is studied by developing a simulation model.

- this model takes the form of a set of assumptions concerning the operation of the system.

(يعبر) the assumptions are expressed in.

mathematical relationships.
logical relationships.
symbolic relationships.

Between the entities of the system.

modeling.

Simplified representation of a system using mathematical equation.

we Simulate a model to study the behavior of a system- need to verify that our model is correct- expect results.

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Types of Models

1- Mathematical or physical model.
2- Static Model
3- Dynamic Model
4. Deterministic Model
5. Stochastic Model
6- Discrete Model
7- Continous Model.

VenSim

is a software designed for modeling one or more quantities that change over time.

 select or drag objear

 delet button

 Lock button

Building the Model

Step 0:- Basic Building Blocks.

Box level variable	Box variables represent quantities. These are the main (nouns) in a system and are sometimes refered to as level variable.

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Rate represent changes over time. these are the main 'verbs' in a system and are sometimes refered to as level variable.

Auxillary variable. represent Constants and other parameters. thes loosely Corespond.

Connects indicate dependencies between objects, In other words ; I need to Knowthis to calculate that.

Building the model.

Step 1:- Adding Box variables.

On monday, 100 students return to school one of whom has the Flue. As time passes, the sick student infects his classmates, who in turn go on to infect others.
this could be generalized as follows.
overtime, susceptible people get sick and become infected people.
to begin building the model, Create Two box variables one For Susceptible people and one For infected people. these will allow you to keep Track of how many healthy and sick people there are.

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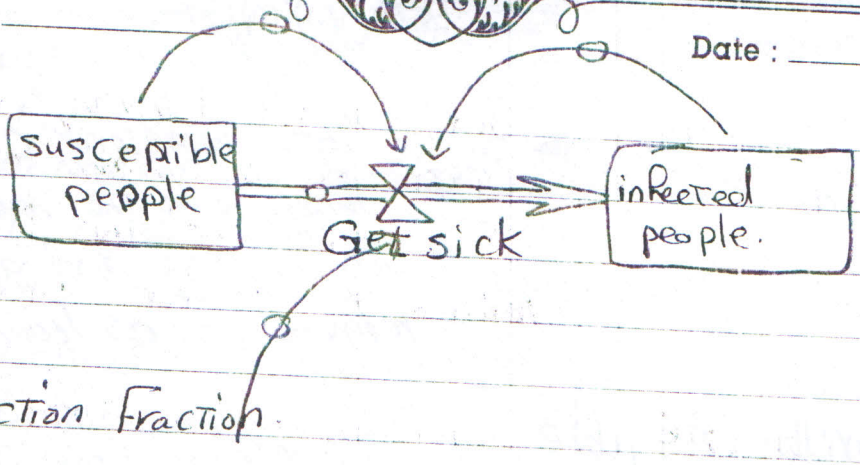

② Step 2 Adding a Rate.

use a rate to Connect these two box variable. it represent a place in the system where something happens. Since this rate represents the number of people who change From susceptible to infected, name it Get sick.

③ Step3 Adding an Auxilary variable

To help calculate the rate at which susceptible people became infected people. Call this variable. ~~infection Fraction~~. it is a ~~efficient~~ rate.

④ Sep4 Adding Connectes.

ven sim PLE needs instructions about wh'c elements depend on each other.
Like the rate Get sick dependons on the number of susceptible people, the nu. of infected people.